STS-108 Flight Readiness Review (FRR) Minutes

The STS-108 FRR convened at 8:00 a.m. on Thursday, November 15, 2001 in the Mission Briefing Room at the Kennedy Space Center (KSC). The meeting was chaired by R. Estess, Space Shuttle Program Lead Center Acting Director.

Flight Crew, Solid Rocket Booster, Ferry Readiness, Range, and DDMS did not have any issues or constraints to flight and did not make formal presentations. Readiness statements submitted were included in the backup package.

The STS-108 FRR presenters were:

Mission Operations – S. Davis (NASA/JSC/DA8),
W. Hale (NASA/JSC/DA8),
T. Sobchak (NASA/GSFC/450),
R. Gest (USA/Houston/DF63)
EVA – E. Mohr (Hamilton Sundstrand/JSC/XA-HAM)
Space and Life Sciences – J. Clark (NASA/JSC/SD26)
Program Integration – R. Galvez (NASA/JSC/MA2),
R. Wallace (NASA/JSC/MS2)
International Space Station –
S. Voss (NASA/JSC/OC),
S. Gahring (NASA/JSC/OB),
M. Sorenson (Boeing/KSC/721G-0004),
R. Swaim (Boeing/JSC/ HMO3-20),
Payload Processing – T. Corey (NASA/KSC/UB-1)
External Tank – L. Servay (LMSSC/MAF/4250)
RSRM – T. Boardman (Thiokol/Utah/L00)
SSME - D. Adamski (Rocketdyne/Canoga Park/55-AB88)
Vehicle Engineering - D. White (USA/Houston/USH-601M)
Shuttle Processing - J. Vevera (USA/KSC/USK-229),
C. Connolly (USA/KSC/USK-459),
M. Leinbach (NASA/KSC/PH)
SR&QA - M. Erminger (NASA/JSC/MQ)

Mission Operations

Mission UF-1 in the International Space Station (ISS) assembly sequence will rotate Expedition 3/4 crews, fly the Multi-Purpose Logistics Module (MPLM) for critical cargo transfer, and perform an oxygen transfer test. The mission will also feature one scheduled extra-vehicular activity. After undocking, the Starshine-2 satellite will be deployed.

Mission requirements, integrated network activity, facility readiness, flight rule changes, and ascent performance were presented.

Extravehicular Activity (EVA)

One planned EVA from the Shuttle airlock will install Beta Gimbal Assembly thermal blankets and perform get-ahead tasks. Consumables exist for a second unscheduled EVA. An electrical short during a Display and Control Module test will not affect any flight hardware on this mission.

Space and Life Sciences
Status was given on crew health, detailed supplementary objectives, radiation analysis and dosimetry support.

Program Integration
Mission requirements call for an 11-day mission, but International Space Station will request a 1-day extension if cryogenic consumables are conserved early in the flight. Multi-Purpose Logistics Module late access and stowage will be demonstrated for the first time 8 days prior to the STS-108 launch. Post flight analysis of a pressure rise in the orbiter main engine 17-inch manifold during the STS-105 flight was not traced to a specific failure, but did result in procedure changes to extend mated coast for 2 seconds. Flight specific guidance, navigation, and control assessments will be performed until a generic re-certification is completed to support STS-112.

International Space Station (ISS)
ISS reviewed three exceptions and three action items related to Stage operations. None of these are a constraint to the STS-108 launch. Progress 6 should be launched and docked to the ISS by November 28, 2001. Offloading of the Progress will be performed after the UF-1/Shuttle mission. On-orbit debris from MPLM racks has been traced to the manufacturing process. UF-1 MPLM rack cleaning and new crew unloading procedures have been enacted to mitigate the debris problem.

Payload Processing
Open work and schedule impacts due to late payload installation were discussed. First time implementation of MPLM late access capability is scheduled for November 21, 2001, which is 8 days prior to launch. The late stowage will consist of 51 bags and 22 cushions.

External Tank (ET)
A redesigned ground gaseous hydrogen vent disconnect will be utilized for the first time as part of Shuttle Upgrades to reduce refurbishment tasks and to enhance sealing capability between ground and flight interfaces. Although planned for ET-122, early implementation was approved in response to the STS-105 disconnect poppet stem failure investigation. Liquid hydrogen recirculation line burst disk leakage during acceptance testing at the supplier was traced to microscopic cracks. The risks associated with a leaking burst disc were evaluated and found to be acceptably low. A repair method will be developed and validated, but there is no constraint for the STS-108/ET-111 flight.

Reusable Solid Rocket Motor (RSRM)
No significant discrepancies were detected during the STS-105 motor disassembly. Unexpected pocketing erosion of lab carbon-cloth phenolic test samples indicated the potential for anomalous nozzle throat thermal performance during launch. Subsequent lab testing and analysis showed material performance was in-family. STS-108 and subsequent motors are safe to fly.

Space Shuttle Main Engine (SSME)
Major components, ignition margins, predicted performance, and redline margins were presented. A portion of a burr ball drill bit was discovered in Engine 2052 powerhead after the STS-105 flight. Subsequent inspections found no damage. Cracks were detected in the nozzle vane trailing edge of a moderate-time Low Pressure Oxygen Turbo Pump nozzle undergoing Block II retrofit. Preliminary structural analysis supported tolerance for large defects. Final investigation results and flight rationale will be presented at the Prelaunch Mission Management Team review.

Vehicle Engineering
All STS-100 and STS-105 anomalies have been reviewed and none constrain the STS-108 flight. Critical Process Changes included the fuel cell separator plate modifications, main propulsion system 2-inch disconnect bushing drawing revision, addition of new sealing epoxy for fuses, and elimination of red adhesive primer for finish applications on the Orbiter.

Some of the sixteen modifications flying for the first time on STS-108 are: thrust structure micro-strain gauge units, payload trunnion latch micro triaxial accelerometer units, critical wire redundancy separations, external tank monoball cable connections (production breaks), auxiliary power unit air half coupling upgrade, panel L4 circuit breaker replacement, elevon flipper door trailing edge bulb seal modification, external tank separation camera modification, wing to fuselage bolt torque change, and Shuttle urine pre-treat assembly.

Special topics included resolution of the Advanced Mission Events Controller (AMEC) anomalies in the Shuttle Avionics Integration Laboratory that were traced to instrumentation/incorrect measurement problems and a defective AMEC unit, worst-case analysis of elongated holes in the LP05 and RP05 Orbital Maneuvering System (OMS) pod #5 attach points showed acceptable capability for flight, high lead level in water tank B introduced by servicing equipment but does not affect crew consumption water in tank A, debris in OV-104 vent door 8 and 9 actuator gearbox (serial number 16) attributed to improper factory assembly, OV-104 rudder speed brake power drive unit (serial number 403) gear scuffing caused by the accepted, but rare, condition of motor backdrive, and on-going analysis of main landing gear wheel tie-bolt hole corrosion.

Shuttle Processing
Micro strain gage/accelerometer installation, aft wire separation modifications, and orbiter frequency response testing were considered planned processing differences while the late payload delivery to the pad, orbiter window inspection, liquid oxygen 17-inch connector repair, main engine #2 yaw actuator replacement, and hurricane threat rollback preparations were unplanned activities that affected pad milestone schedules. Damage to the External Tank ground gaseous hydrogen vent quick disconnect poppet stem during STS-105 was determined to be an isolated failure. A new, redesigned unit was installed on ET-111.

Safety, Reliability and Quality Assurance
Significant Assessments have been performed on the OV-105 OMS pod #5 attach points, orbiter wheel corrosion, display and control module electrical failure, STS-104 main engine high pressure fuel turbo pump post-shutdown pressure rise, low pressure oxidizer turbo pump nozzle vane crack, unusual pocketing of solid rocket motor phenolic material during testing, and space station solar array power-on condition during extra-vehicular activities. One new, Accepted Risk hazard for fire and/or explosion in the orbiter aft compartment caused by the Micro strain gauge units was baselined for STS-108. Two new criticality 1/1 Critical Items Lists (CIL's) were identified for orifice erosion on gaseous hydrogen and oxygen flow control valves. Three criticality 1R/2 CIL's were upgraded to 1/1: rupture/leakage of the gaseous helium 3-way solenoid valves; failure of the gaseous oxygen pressurization system repress isolation check valve; and contact-to-contact short of the gaseous hydrogen flow control valve close switch.

Exceptions/Action Items
There were four Certificate of Flight Readiness Exceptions: low pressure oxidizer turbo pump inlet nozzle vane trailing edge crack discovered on a moderate-time unit (not installed on OV-105); auxiliary power units #1 and #2 fuel tank bladders exposed to

excessive delta pressure; midbody boron struts found in OV-103 bay 7 with damage due to improper clamp installation; and suspect main landing gear wheel tie bolt hole corrosion. An action was assigned to Vehicle Engineering by Mr. Estess to provide additional main landing gear wheel corrosion test rationale to Headquarters, Code Q.

The four exceptions and one action item will be closed with final flight rationale at the Prelaunch Mission Management Team meeting scheduled for November 27, 2001.

Mr. Estess polled the principal managers and organizations; all responded ready to support the STS-108 mission.

James D. Halsell, Jr.
Colonel, USAF
Manager, Launch Integration

Enclosures:
Agenda
Action Log
Exception Log

STS-108
Flight Readiness Review
November 15, 2001

Agenda

Introduction	Manager, Launch Integration
Mission Operations	Director, Mission Operations APM, Flight Operations, SFOC
EVA	Manager, EVA Project
Flight Crew	Director, Flight Crew Operations
Space and Life Sciences	Director, Space and Life Sciences
Program Integration	Flight Manager Manager, Space Shuttle KSC Integration Manager, Space Shuttle Systems Integration Manager, Space Shuttle Customer and Flight Integration APM, Program Integration, SFOC
International Space Station	Manager, International Space Station Program
Payload Processing	Director of ISS/Payloads Processing
External Tank	Manager, External Tank Project
RSRM	Manager, Reusable Solid Rocket Motor Project
SRB	Manager, Solid Rocket Booster Project APM, SRB Element, SFOC
SSME	Manager, Space Shuttle Main Engine Project
Vehicle Engineering	Manager, Space Shuttle Vehicle Engineering APM, Orbiter Element, SFOC APM, Flight Software, SFOC APM, FCE/EVA, SFOC
Ferry Readiness	Ferry Operations Manager
Shuttle Processing	Director of Shuttle Processing APM, Ground Operations, SFOC APM, Integrated Logistics, SFOC
Range	United States Air Force
DDMS	Director, DDMS
Space Shuttle SR&QA	Manager, Safety, Reliability and Quality Assurance
Exception/Action Summaries	Manager, Launch Integration
Readiness Poll	Lead Center Director for Space Shuttle and Space Station Programs

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ACTION ITEM LOG

CONTROL NO.	ASSIGNEE(S)	ACTION	C	DUE DATE	CLOSURE DATE
108-FRR-001	VEHICLE ENGINEERING	PROVIDE ADDITIONAL MAIN LANDING GEAR WHEEL CORROSION TEST RATIONALE TO CODE Q. PROVIDE SUMMARY OF ADDITIONAL TEST RATIONALE ALONG WITH TEST RESULTS AND OVERALL RATIONALE FOR FLIGHT AT THE STS-108 PMMT REVIEW.	C	STS-108 PMMT	

C - CONSTRAINT TO MILESTONE

CoFR EXCEPTION LOG

CoFR REVIEW DATE: 11-15-01

STS FLT NO. STS-108

REQUIREMENT/ EXCEPTION NUMBER	ELEMENT	DESCRIPTION OF EXCEPTION	DUE DATE
001	SSME	UCR A034411 IS OPEN. LOW PRESSURE OXIDIZER TURBOPUMP (LPOTP) TURBINE INLET NOZZLE VANE TRAILING EDGE CRACK WAS DISCOVERED ON A MODERATE TIME UNIT. THREE ACTIONS ARE IN WORK TO DEVELOP FINAL FLIGHT RATIONALE: 1. ADDITIONAL VANE INSPECTIONS. 2. MATERIALS ANALYSIS. 3. STRUCTURAL ANALYSIS.	**STS-108 PMMT**
002	VEHICLE ENGINEERING	APU 1 & 2 FUEL TANK BLADDERS EXPOSED TO EXCESSIVE DELTA PRESSURE, (55 PSID; SHOULD BE 5 PSID MAX.). LEAK CHECK BLADDERS TO VALIDATE NO LEAKS. PERFORM STRESS ANALYSIS TO VERIFY NO OVER STRESS.	**STS-108 PMMT**
003	VEHICLE ENGINEERING	MIDBODY BORON STRUT FOUND IN OV-103 BAY 7 WITH DAMAGE DUE TO IMPROPER CLAMP INSTALLATION. INSPECT CLAMPS ON OV-102, OV-103, AND OV-104 TO DETERMINE IF THE PROBLEM IS GENERIC.	**STS-108 PMMT**
004	VEHICLE ENGINEERING	SUSPECT MAIN LANDING GEAR TIE BOLT HOLE CORROSION. WPAFB TESTING TO VALIDATE WORST CASE CORROSION SEEN ON WHEELS TO CONFIRM WHEELS CAN SUPPORT A NOMINAL LANDING.	**STS-108 PMMT**